The Dark Side of the Higgs Field is a Fifth Force?

A new proposal for an experiment that could test the presence of a fifth force with unprecedented precision. [9]

The gravitational force attracting the matter, causing concentration of the matter in a small space and leaving much space with low matter concentration: dark matter and energy.

The magnetic induction creates a negative electric field, causing an electromagnetic inertia responsible for the relativistic mass change; it is the mysterious Higgs Field giving mass to the particles. The Planck Distribution Law of the electromagnetic oscillators explains the electron/proton mass rate by the diffraction patterns. The accelerating charges explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the wave particle duality and the electron's spin also, building the bridge between the Classical and Relativistic Quantum Theories. The self maintained electric potential of the accelerating charges equivalent with the General Relativity space-time curvature, and since it is true on the quantum level also, gives the base of the Quantum Gravity.

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Preface

Search for Invisible Decays of a Higgs Boson

A search for evidence of invisible-particle decay modes of a Higgs boson produced in association with a Z boson at the Large Hadron Collider is presented. No deviation from the standard model expectation is observed in 4.5 fb−1 (20.3 fb−1) of 7 (8) TeV pp collision data collected by the ATLAS experiment. Assuming the standard model rate for ZH production, an upper limit of 75%, at the 95% confidence level is set on the branching ratio to invisible-particle decay modes of the Higgs boson at a mass of 125.5 GeV. The limit on the branching ratio is also interpreted in terms of an upper limit on the allowed dark matter-nucleon scattering cross section within a Higgs-portal dark matter scenario. Within the constraints of such a scenario, the results presented in this Letter provide the strongest available limits for low-mass dark matter candidates. Limits are also set on an additional neutral Higgs boson, in the mass range 110 < mH < 400 GeV, produced in association with a Z boson and decaying to invisible particles. [3]

Popular questions about the Higgs Field:

1.) If the Higgs field is responsible for imbuing particles with mass, and mass is responsible for gravity, is it possible that the Higgs field will provide the missing link between general relativity and quantum mechanics i.e. could the Higgs field be the basis of a quantum theory of gravity?

2.) Can the theoretical Higgs Field be used as the “cause” of relativistic momentum or relativistic kinetic energy of a moving body?

3.) Does Einstein's General Relativity need to be adjusted for the Higgs field?

4.) Since the Higgs field gives most particles mass, and permeates all space, then GR needs the Higgs field to be a theory of space?

5.) So where GR is highly curved, the Higgs field is also curved? And does a highly curved Higgs field affect the way particles acquire mass? For that matter, a curved space-time would also curve electromagnetic field?

How can we answer these questions?

Another bridge between the classical and quantum mechanics in the realm of relativity is that the charge distribution is lowering in the reference frame of the accelerating charges linearly: ds/dt = at (time coordinate), but in the reference frame of the current it is parabolic: $s = a/2\ t^2$ (geometric coordinate).

One origin of the Quantum Physics is the Planck Distribution Law of the electromagnetic oscillators, giving equal intensity for 2 different wavelengths on any temperature. Any of these two wavelengths will give equal intensity diffraction patterns, building different asymmetric constructions, for example proton - electron structures (atoms), molecules, etc. Since the particles are centers of diffraction patterns they also have particle – wave duality as the electromagnetic waves have. [2]

This paper explains the magnetic effect of the electric current from the observed effects of the accelerating electrons, causing naturally the experienced changes of the electric field potential along the electric wire. The accelerating electrons explain not only the Maxwell Equations and the Special Relativity, but the Heisenberg Uncertainty Relation, the wave particle duality and the electron's spin also, building the bridge between the Classical and Quantum Theories. [1]

The Electroweak Interaction shows that the Weak Interaction is basically electromagnetic in nature. The arrow of time shows the entropy grows by changing the temperature dependent diffraction patterns of the electromagnetic oscillators.

The Chameleon in the Vacuum Chamber

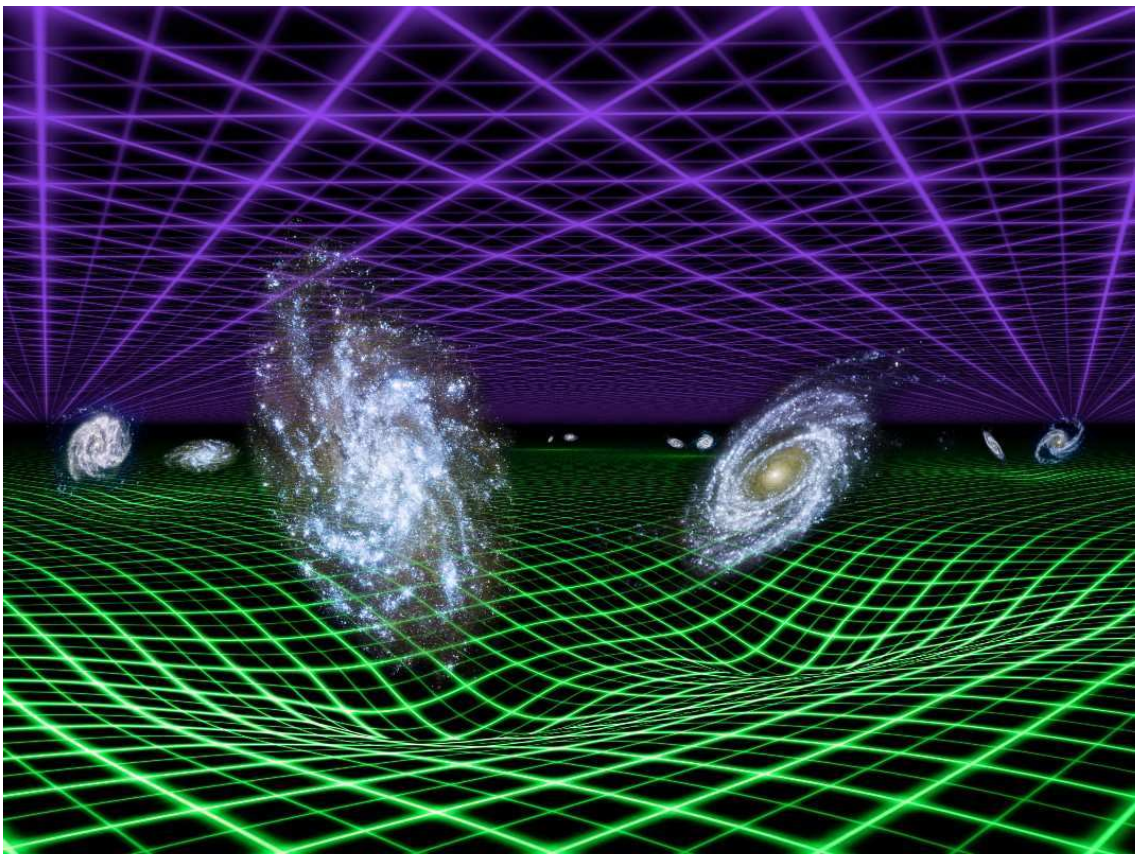
Physicists have been speculating for a while now that our universe needs a fifth fundamental force, one responsible for the phenomenon of dark energy, to maintain the observed expansion rate. Although this idea has been around for more than a decade, it has turned out to be very difficult to test. A new paper by Burrage, Copeland and Hinds from the UK now proposes a test based on measuring the gravitational attraction felt by single atoms.

Dark energy is often portrayed as mysterious stuff that fills the universe and pushes it apart, but stuff and forces aren't separate things. Stuff can be a force carrier that communicates an interaction between other particles. In its simplest form, dark energy is an unspecified smooth, inert, and unchanging constant, the "cosmological constant."

But for many theorists, such a constant is unsatisfactory because its origin is left unexplained. A more satisfying explanation would be a dark-energy-field that fills the universe and has the desired effect of accelerating the expansion by modifying the gravitational interaction on long, super-galactic, distances. Adding a fifth force rather than a cosmological constant would integrate dark energy better into the theoretical framework of the standard model.

The problem with using fields to modify the gravitational interaction on long distances and to thus explain the observations is that one quickly runs into problems at shorter distances. The same field that needs to be present between galaxies to push them apart should not be present within the galaxies, or within solar systems, because we should have noticed that already.

About a decade ago, Weltman and Khoury pointed out that a dark energy field would not affect gravity on short distances if it was suppressed by the density of matter. The higher the density of matter, the smaller the value of the dark energy field, and the less it would affect the gravitational attraction. Such a field thus would be very weak within our galaxies, and only make itself noticeable between galaxies where the matter density is very low. They called this type of dark energy field the "chameleon field" because it seems to hide itself and merges into the background.



Almost all matter in the universe, including dark matter, is concentrated in galaxies. The chameleon field instead concentrates in the otherwise almost empty space between galaxies. Image source: Swinburne University of Technology
http://www.swinburne.edu.au/chancellery/mediacentre/media-centre/news/2011/05/dark-energy-is-real

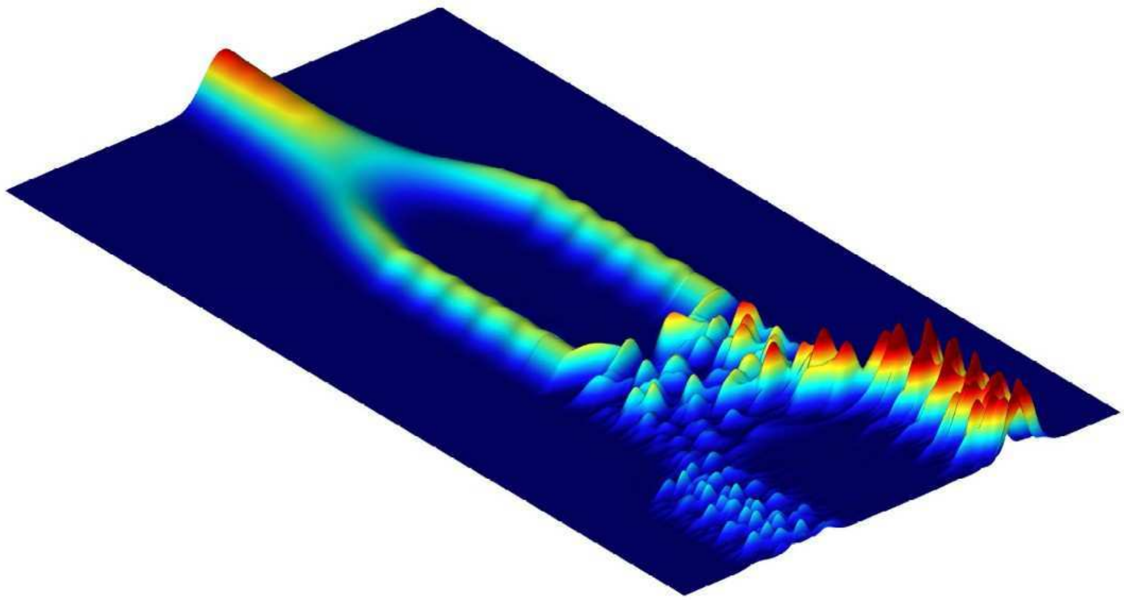
This dependence of the chameleon field on the matter density comes about because of the way it interacts with other particles (including dark matter). Besides this unusual interaction though, it is a normal scalar field, that is the simplest sort of field there is, similar to the Higgs field and the conjectured inflation field that is believed to cause the fast expansion of the universe in its very early stages. The chameleon field is characterized by only two parameters that is the strength of its interaction with other matter, and the interaction with itself. It is an appealing explanation for dark energy because it is simple.

But the very same property that makes the chameleon field such an appealing explanation for dark energy is also what makes it so hard to test. “Fifth force” experiments in the laboratory measure the gravitational interaction to very high precision, and they have so far reproduced standard gravity with ever increasing reliability, going all the way down to micron-scale measurements. These experiments are, however, not sensitive to the chameleon field, at least not in the parameter range in which it might explain dark energy. That is because the existing fifth force experiments measure the gravitational force between two macroscopic probes, for example two metallic plates, and the high density of the probes themselves suppresses the field one is trying to measure.

In their new paper, Burrage et al. show that one does not run into this problem if one uses a different setting. To begin with they say the experiment should be done in a vacuum chamber as to get the background matter density to be as small as possible, and the value of the chameleon field as high as possible. The authors then show that the value of the field inside the chamber depends on the size of the chamber and the quality of the vacuum, and that the field increases towards the middle of the chamber. They calculate the force between a very small, for example atomic, sample and a larger sample, and show that the atom is too small to cause a large suppression of the chameleon field. The suppression, it turns out, depends not only on the density of the sample but, in the given configuration, also on the radius of the sample. One atom doesn’t suppress the chameleon field much simply because it is small.

The gravitational attraction between two atoms is too feeble to be measurable, so one still needs one macroscopic body. But when one looks at the numbers, replacing one macroscopic probe with a microscopic one would be enough to make the experiment sensitive to find out whether dark energy is a chameleon field, either in part or in whole.

One way to realize such an experiment would be by using atom interferometry which has previously been demonstrated to be sensitive to the gravitational force. In these experiments, an atom beam is split in two, one half of it is subjected to some field, and then the beams are combined again. From the resulting interference pattern one can extract the force that acted on the beams. A similar setting could be used to test the chameleon field.



Interferometry: A beam is split into two parts, which are then rejoined. From the way in which the two beams interfere; one can deduce which forces acted on the beams. Image source: TU Wien http://www.tuwien.ac.at/dle/pr/aktuelles/downloads/2013/quantenrauschen/

Holger Müller from the University of California at Berkeley, an experimentalist who works on atom interferometry, thinks it is possible to do the experiment. "It's amazing to see how an experiment that is very realistic with current technology is able to probe dark energy. The technology should even allow surpassing the sensitivity expected by Burrage et al.," he said.

I find this a very interesting paper, and also a hopeful one. It shows that while sending satellites into orbit and building multi-billion dollar colliders are promising ways to search for new physics, they are not the only ways. New physics can also hide in high precision measurements in your university lab. A tiny deviation from your expected results might not be an indicator of a flawed experiment, but rather the first hint of revolutionary new physics; just ask the theorists. Who knows? There might be a chameleon hidden in your vacuum chamber. [9]

Electromagnetic Field and Quantum Theory

Needless to say that the accelerating electrons of the steady stationary current are a simple demystification of the magnetic field, by creating a decreasing charge distribution along the wire, maintaining the decreasing U potential and creating the **A** vector potential experienced by the electrons moving by **v** velocity relative to the wire. This way it is easier to understand also the time dependent changes of the electric current and the electromagnetic waves as the resulting fields moving by c velocity.

It could be possible something very important law of the nature behind the self maintaining **E** accelerating force by the accelerated electrons. The accelerated electrons created electromagnetic fields are so natural that they occur as electromagnetic waves traveling with velocity c. It shows that the electric charges are the result of the electromagnetic waves diffraction.
One of the most important conclusions is that the electric charges are moving in an accelerated way and even if their velocity is constant, they have an intrinsic acceleration anyway, the so called spin, since they need at least an intrinsic acceleration to make possible they movement .
The bridge between the classical and quantum theory is based on this intrinsic acceleration of the spin, explaining also the Heisenberg Uncertainty Principle. The particle – wave duality of the electric charges and the photon makes certain that they are both sides of the same thing. Basing the gravitational force on the accelerating Universe caused magnetic force and the Planck Distribution Law of the electromagnetic waves caused diffraction gives us the basis to build a Unified Theory of the physical interactions. [1]

The Classical Relativistic effect

The moving charges are self maintain the electromagnetic field locally, causing their movement and this is the result of their acceleration under the force of this field.
In the classical physics the charges will distributed along the electric current so that the electric potential lowering along the current, by linearly increasing the way they take every next time period because this accelerated motion.

The Relativistic Quantum Mechanics

The same thing happens on the atomic scale giving a dp impulse difference and a dx way difference between the different part of the not point like particles.

Commonly accepted idea that the relativistic effect on the particle physics it is the fermions' spin - another unresolved problem in the classical concepts. If the electric charges can move only with accelerated motions in the self maintaining electromagnetic field, once upon a time they would reach the velocity of the electromagnetic field. The resolution of this problem is the spinning particle, constantly accelerating and not reaching the velocity of light because the acceleration is radial.

The Heisenberg Uncertainty Relation

I think that we have a simple bridge between the classical and quantum mechanics by understanding the Heisenberg Uncertainty Relations. It makes clear that the particles are not point like but have a dx and dp uncertainty.

The General Relativity - Electromagnetic inertia and mass

Electromagnetic Induction

Since the magnetic induction creates a negative electric field as a result of the changing acceleration, it works as an electromagnetic inertia, causing an electromagnetic mass. [1]

Relativistic change of mass

The increasing mass of the electric charges the result of the increasing inductive electric force acting against the accelerating force. The decreasing mass of the decreasing acceleration is the result of the inductive electric force acting against the decreasing force. This is the relativistic mass change explanation, especially importantly explaining the mass reduction in case of velocity decrease.

The frequency dependence of mass

Since $E = h\nu$ and $E = mc^2$, $m = h\nu / c^2$ that is the m depends only on the ν frequency. It means that the mass of the proton and electron are electromagnetic and the result of the electromagnetic induction, caused by the changing acceleration of the spinning and moving charge! It could be that the m_o inertial mass is the result of the spin, since this is the only accelerating motion of the electric charge. Since the accelerating motion has different frequency for the electron in the atom and the proton, they masses are different, also as the wavelengths on both sides of the diffraction pattern, giving equal intensity of radiation.

Electron – Proton mass rate

The Planck distribution law explains the different frequencies of the proton and electron, giving equal intensity to different lambda wavelengths! Also since the particles are diffraction patterns they have some closeness to each other – can be seen as a gravitational force. [2]

There is an asymmetry between the mass of the electric charges, for example proton and electron, can understood by the asymmetrical Planck Distribution Law. This temperature dependent energy distribution is asymmetric around the maximum intensity, where the annihilation of matter and antimatter is a high probability event. The asymmetric sides are creating different frequencies of electromagnetic radiations being in the same intensity level and compensating each other. One of these compensating ratios is the electron – proton mass ratio. The lower energy side has no compensating intensity level, it is the dark energy and the corresponding matter is the dark matter.

The Higgs boson

By March 2013, the particle had been proven to behave, interact and decay in many of the expected ways predicted by the Standard Model, and was also tentatively confirmed to have + parity and zero spin, two fundamental criteria of a Higgs boson, making it also the first known scalar particle to be discovered in nature, although a number of other properties were not fully proven and some partial results do not yet precisely match those expected; in some cases data is also still awaited or being analyzed.

In my opinion, the best explanation of the Higgs mechanism for a lay audience is the one invented by David Miller. You can find it here: http://www.strings.ph.qmul.ac.uk/~jmc/epp/higgs3.html .
The field must come first. The boson is an excitation of the field. So no field, no excitation. On the other hand in quantum field theory it is difficult to separate the field and the excitations.
The Higgs field is what gives particles their mass.
There is a video that gives an idea as to the Higgs field and the boson. It is here: http://www.youtube.com/watch?v=RIg1Vh7uPyw . Note that this analogy isn't as good as the Miller one, but as is usually the case, if you look at all the analogies you'll get the best understanding of the situation.

Since the Higgs boson is necessary to the W and Z bosons, the dipole change of the Weak interaction and the change in the magnetic effect caused gravitation must be conducted. The Wien law is also important to explain the Weak interaction, since it describes the T_{max} change and the diffraction patterns change. [2]

Higgs mechanism

The magnetic induction creates a negative electric field, causing an electromagnetic inertia. Probably it is the mysterious Higgs field giving mass to the charged particles? We can think about the photon as an electron-positron pair, they have mass. The neutral particles are built from negative and positive charges, for example the neutron, decaying to proton and electron. The wave – particle duality makes sure that the particles are oscillating and creating magnetic induction as an inertial mass, explaining also the relativistic mass change. Higher frequency creates stronger magnetic induction, smaller frequency results lesser magnetic induction. It seems to me that the magnetic induction is the secret of the Higgs field.

In particle physics, the Higgs mechanism is a kind of mass generation mechanism, a process that gives mass to elementary particles. According to this theory, particles gain mass by interacting with the Higgs field that permeates all space. More precisely, the Higgs mechanism endows gauge bosons in a gauge theory with mass through absorption of Nambu–Goldstone bosons arising in spontaneous symmetry breaking.

The simplest implementation of the mechanism adds an extra Higgs field to the gauge theory. The spontaneous symmetry breaking of the underlying local symmetry triggers conversion of components of this Higgs field to Goldstone bosons which interact with (at least some of) the other fields in the theory, so as to produce mass terms for (at least some of) the gauge bosons. This mechanism may also leave behind elementary scalar (spin-0) particles, known as Higgs bosons.

In the Standard Model, the phrase "Higgs mechanism" refers specifically to the generation of masses for the $W^{\pm}$, and Z weak gauge bosons through electroweak symmetry breaking. The Large Hadron Collider at CERN announced results consistent with the Higgs particle on July 4, 2012 but stressed that further testing is needed to confirm the Standard Model.

Gravity from the point of view of quantum physics

What is the Spin?

So we know already that the new particle has spin zero or spin two and we could tell which one if we could detect the polarizations of the photons produced. Unfortunately this is difficult and neither ATLAS nor CMS are able to measure polarizations. The only direct and sure way to confirm that the particle is indeed a scalar is to plot the angular distribution of the photons in the rest frame of the centre of mass. A spin zero particles like the Higgs carries no directional information away from the original collision so the distribution will be even in all directions. This test will be possible when a much larger number of events have been observed. In the mean time we can settle for less certain indirect indicators.

The Gravitational force

The gravitational attractive force is basically a magnetic force.

The same electric charges can attract one another by the magnetic force if they are moving parallel in the same direction. Since the electrically neutral matter is composed of negative and positive charges they need 2 photons to mediate this attractive force, one per charges. The Bing Bang caused parallel moving of the matter gives this magnetic force, experienced as gravitational force.

Since graviton is a tensor field, it has spin = 2, could be 2 photons with spin = 1 together.

You can think about photons as virtual electron – positron pairs, obtaining the necessary virtual mass for gravity.

The mass as seen before a result of the diffraction, for example the proton – electron mass rate Mp=1840 Me. In order to move one of these diffraction maximum (electron or proton) we need to intervene into the diffraction pattern with a force appropriate to the intensity of this diffraction maximum, means its intensity or mass.

The Big Bang caused acceleration created radial currents of the matter, and since the matter is composed of negative and positive charges, these currents are creating magnetic field and attracting forces between the parallel moving electric currents. This is the gravitational force experienced by the matter, and also the mass is result of the electromagnetic forces between the charged particles. The positive and negative charged currents attracts each other or by the magnetic forces or by the much stronger electrostatic forces!?

The Graviton

In physics, the graviton is a hypothetical elementary particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton is expected to be massless (because the gravitational force appears to have unlimited range) and must be a spin-2 boson. The spin follows from the fact that the source of gravitation is the stress-energy tensor, a second-rank tensor (compared to electromagnetism's spin-1 photon, the source of which is the four-current, a first-rank tensor). Additionally, it can be shown that any massless spin-2 field would give rise to a force indistinguishable from gravitation, because a massless spin-2 field must couple to (interact with) the stress-energy tensor in the same way that the gravitational field does. This result suggests that, if a massless spin-2 particle is discovered, it must be the graviton, so that the only experimental verification needed for the graviton may simply be the discovery of a massless spin-2 particle. [3]

Dark Matter and Energy

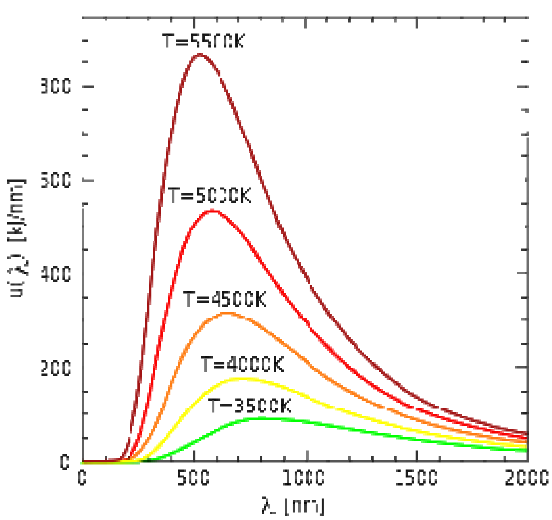
Dark matter is a type of matter hypothesized in astronomy and cosmology to account for a large part of the mass that appears to be missing from the universe. Dark matter cannot be seen directly with telescopes; evidently it neither emits nor absorbs light or other electromagnetic radiation at any significant level. It is otherwise hypothesized to simply be matter that is not reactant to light. Instead, the existence and properties of dark matter are inferred from its gravitational effects on visible matter, radiation, and the large-scale structure of the universe. According to the Planck mission team, and based on the standard model of cosmology, the total mass–energy of the known universe contains 4.9% ordinary matter, 26.8% dark matter and 68.3% dark energy. Thus, dark matter is estimated to constitute 84.5% of the total matter in the universe, while dark energy plus dark matter constitute 95.1% of the total content of the universe. [6]

Cosmic microwave background

The cosmic microwave background (CMB) is the thermal radiation assumed to be left over from the "Big Bang" of cosmology. When the universe cooled enough, protons and electrons combined to form neutral atoms. These atoms could no longer absorb the thermal radiation, and so the universe became transparent instead of being an opaque fog. [7]

Thermal radiation

Thermal radiation is electromagnetic radiation generated by the thermal motion of charged particles in matter. All matter with a temperature greater than absolute zero emits thermal radiation. When the temperature of the body is greater than absolute zero, interatomic collisions cause the kinetic energy of the atoms or molecules to change. This results in charge-acceleration and/or dipole oscillation which produces electromagnetic radiation, and the wide spectrum of radiation reflects the wide spectrum of energies and accelerations that occur even at a single temperature. [8]



Conclusions

The gravitational attraction between two atoms is too feeble to be measurable, so one still needs one macroscopic body. But when one looks at the numbers, replacing one macroscopic probe with a microscopic one would be enough to make the experiment sensitive to find out whether dark energy is a chameleon field, either in part or in whole.

One way to realize such an experiment would be by using atom interferometry which has previously been demonstrated to be sensitive to the gravitational force. In these experiments, an atom beam is split in two, one half of it is subjected to some field, and then the beams are combined again. From the resulting interference pattern one can extract the force that acted on the beams. A similar setting could be used to test the chameleon field. [9]

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The electric currents causing self maintaining electric potential is the source of the special and general relativistic effects. The Higgs Field is the result of the electromagnetic induction. The Graviton is two photons together. [3]

References

[1] The Magnetic field of the Electric current and the Magnetic induction

http://academia.edu/3833335/The_Magnetic_field_of_the_Electric_current

[2] 3 Dimensional String Theory

http://academia.edu/3834454/3_Dimensional_String_Theory

[3] Graviton Production By Two Photon and Electron-Photon Processes In Kaluza-Klein Theories With Large Extra Dimensions

http://arxiv.org/abs/hep-ph/9909392

[4] Search for Invisible Decays of a Higgs Boson

http://journals.aps.org/prl/pdf/10.1103/PhysRevLett.112.201802

[5] http://en.wikipedia.org/wiki/Einstein_field_equations

[6] http://en.wikipedia.org/wiki/Dark_matter

[7] http://en.wikipedia.org/wiki/Cosmic_microwave_background

[8] http://en.wikipedia.org/wiki/Thermal_radiation

[9] https://medium.com/starts-with-a-bang/the-chameleon-in-the-vacuum-chamber-ebf164e2d79e